	Inventor	S	C	P	2	3	4	5	Image Doc. Displayed	PT
1	DING, JIAN	☒	☐	☐	☐	☐	☐	☐	US 20010054601	☐
2	COOK, ROBERT C. et al.	☒	☐	☐	☐	☐	☐	☐	US 20010041218	☐
3	Collins, Kenneth S.	☒	☐	☐	☐	☐	☐	☐	US 6589437	☐
4	Collins, Kenneth et al.	☒	☐	☐	☐	☐	☐	☐	US 6514376	☐
5	Cook, Robert C. et al.	☒	☐	☐	☐	☐	☐	☐	US 6506691	☐
6	Marks, Steven et al.	☒	☐	☐	☐	☐	☐	☐	US 6486069	☐

	U	1 [1]	Document ID	Issue Date	Pages	Title	Current OR	Current XRef	Retrieval Classif
7	☐	☒	US 6331483 B1	20011218	19	Method of film-forming of tungsten	438/648	427/123; 427/124; 427/250; 438/656; 438/685; 438/761; 438/763	
8	☐	☒	US 6300256 B1	20011009	17	Method and device for producing electrically conductive continuity in semiconductor components	438/795	219/413; 257/E21.597; 257/E31.112; 438/799	
9	☐	☒	US 6238588 B1	20010529	33	High pressure high non-reactive diluent gas content high plasma ion density plasma oxide etch process	216/68	204/192.32; 204/192.37; 216/67; 216/79; 257/E21.252; 438/707; 438/710; 438/719; 438/723; 438/725	
10	☐	☒	US 6218312 B1	20010417	29	Plasma reactor with heated source of a polymer-hardening precursor material	438/723	156/345.27; 156/345.37; 257/E21.252	
11	☐	☒	US 6143079 A	20001107	14	Compact process chamber for improved process uniformity	118/715	118/620; 118/641; 118/728; 118/729	
12	☐	☒	US 5819684 A	19981013	14	Gas injection system for reaction chambers in CVD systems	118/715	427/248.1	

	Inventor	S	C	P	2	3	4	5	Image Doc. Displayed	PT
7	Ishizuka, Hotaka et al.	☒	☐	☐	☐	☐	☐	☐	US 6331483	☐
8	Kriegel, Bernd et al.	☒	☐	☐	☐	☐	☐	☐	US 6300256	☐
9	Collins, Kenneth et al.	☒	☐	☐	☐	☐	☐	☐	US 6238588	☐
10	Collins, Kenneth S. et al.	☒	☐	☐	☐	☐	☐	☐	US 6218312	☐
11	Halpin, Michael W.	☒	☐	☐	☐	☐	☐	☐	US 6143079	☐
12	Hawkins, Mark R. et al.	☒	☐	☐	☐	☐	☐	☐	US 5819684	☐

	U	1 [1]	Document ID	Issue Date	Pages	Titl	Current OR	Current XRef	Retrieval Classif
13	☐	☒	US 5814365 A	19980929	12	Reactor and method of processing a semiconductor substate	427/10	118/666; 118/708; 118/712; 118/715; 118/725; 118/730; 374/131; 374/141; 427/248.1	
14	☐	☒	US 5629054 A	19970513	97	Method for continuously forming a functional deposit film of large area by micro-wave plasma CVD method	427/575	118/723MW	
15	☐	☒	US 5525157 A	19960611	14	Gas injectors for reaction chambers in CVD systems	118/715	118/725; 118/730	
16	☐	☒	US 5232145 A	19930803	9	Method of soldering in a controlled-convection surface-mount reflow furnace	228/102	219/390; 219/497; 228/180.1; 228/232	

	Inventor	S	C	P	2	3	4	5	Image Doc. Displayed	PT
13	Mahawili, Imad	☒	☐	☐	☐	☐	☐	☐	US 5814365	☐
14	Kanai, Masahiro	☒	☐	☐	☐	☐	☐	☐	US 5629054	☐
15	Hawkins, Mark R. et al.	☒	☐	☐	☐	☐	☐	☐	US 5525157	☐
16	Alley, Richard C. et al.	☒	☐	☐	☐	☐	☐	☐	US 5232145	☐

US-PAT-NO: 6486069

DOCUMENT-IDENTIFIER: US 6486069 B1

TITLE: Cobalt silicide etch process and apparatus

---------- KWIC ---------

Detailed Description Text - DETX (21):
Immediately below the solid source 250 is the electrostatic wafer chuck 252 which positions the semiconductor wafer 248 relative to the reactor chamber 222. Wafer centering ring 253 centers the wafer 248 on the wafer chuck 252. In this embodiment, the wafer chuck 252 as well as the bottom electrode 228 can be moved vertically downward in order to insert and remove the wafer 248. As can be seen in FIGS. 2 and 3, a backside gas delivery space 255 is depicted. As described more fully with a description of the chuck, a gas such as helium can be **selectively** delivered to space 255 in order to **selectively control** the temperature of wafer 248.

Detailed Description Text - DETX (41):
Immediately below the solid source 650 is the electrostatic wafer chuck 652 which positions the semiconductor wafer 648 relative to the reactor chamber 622. Wafer centering ring 653 centers the wafer 648 on the wafer chuck 652. In this embodiment, the wafer chuck 652 as well as the bottom electrode 628 can be moved vertically downward in order to insert and remove the wafer 648. As can be seen in FIGS. 6 and 7, a backside gas delivery space 655 is depicted. As described more fully with a description of the chuck a gas such as helium

can be **selectively** delivered to space 655 in order to
selectively control the
temperature of wafer 648.

US-PAT-NO: 6238588

DOCUMENT-IDENTIFIER: US 6238588 B1

TITLE: High pressure high non-reactive diluent gas content high plasma ion density plasma oxide etch process

---------- KWIC ---------

Detailed Description Text - DETX (34):

FIG. 17A illustrates a variation of the embodiment of FIG. 5 in which the ceiling 52 and side wall 50 are separate semiconductor (e.g., silicon) pieces insulated from one another having separately controlled RF bias power levels applied to them from respective RF sources 210, 212 to enhance control over the center etch rate and selectivity relative to the edge. As set forth in greater detail in above-referenced U.S. application Ser. No. 08/597,577 filed Feb. 2, 1996 by Kenneth S. Collins et al., the ceiling 52 may be a semiconductor (e.g., silicon) material doped so that it will act as an electrode capacitively coupling the RF bias power applied to it into the chamber and simultaneously as a window through which RF power applied to the solenoid 42 may be inductively coupled into the chamber. The advantage of such a window-electrode is that an RF potential may be established directly over the wafer (e.g., for controlling ion energy) while at the same time inductively coupling RF power directly over the wafer. This latter feature, in combination with the **separately controlled** inner and outer solenoids 42, 90 and center and peripheral gas feeds 64a, 64b greatly enhances the ability to adjust various plasma

process parameters such as ion density, ion energy, etch rate and etch selectivity at the workpiece center relative to the workpiece edge to achieve an optimum uniformity. In this combination, gas flow rates through individual gas feeds are individually and **separately controlled** to achieve such optimum uniformity of plasma process parameters.

L Number	Hits	Search Text	DB	Time stamp
1	2507	(heating or cooling or annealing or RTP) and gas and (control$3 with gas with (separately or selectively))	USPAT; US-PGPUB	2003/08/01 13:41
2	2094	((heating or cooling or annealing or RTP) and gas and (control$3 with gas with (separately or selectively))) and @ad<20000317	USPAT; US-PGPUB	2003/08/01 13:41
3	430	(((heating or cooling or annealing or RTP) and gas and (control$3 with gas with (separately or selectively))) and @ad<20000317) and (wafer or substrate)	USPAT; US-PGPUB	2003/08/01 13:43
4	68	((((heating or cooling or annealing or RTP) and gas and (control$3 with gas with (separately or selectively))) and @ad<20000317) and (wafer or substrate)) and lamps	USPAT; US-PGPUB	2003/08/01 13:43

US-PAT-NO: 5814365

DOCUMENT-IDENTIFIER: US 5814365 A
See image for Certificate of Correction

TITLE: Reactor and method of processing a semiconductor
substate

---------- KWIC ---------

Detailed Description Text - DETX (2):
Referring now to the drawings and particular to FIGS. 1 and 2, a reactor for processing semiconductor substrates is generally indicated by the numeral 10. In the illustrated embodiment, reactor 10 comprises a single wafer processing reactor that is suitable for performing various fabrication processes on a semiconductor substrate 12, such as a semiconductor wafer. Reactor 10 is particularly suitable for thermal processing of a semiconductor wafer. Such thermal processes include thermal annealing of a semiconductor wafer and thermal reflow of boro-phosphorous gasses, and chemical vapor deposition of thin film applications, such as high temperature oxide, low temperature oxide, high temperature nitride, doped and undoped polysilicon, silicon epitaxial and tungsten metal and tungsten silicide films, in the fabrication of a semiconductor device. The control of these processes depends on the control of gas flow, gas pressure, and wafer temperature. As will be described in more detail, reactor 10 includes a heater assembly 14, which delivers heat to the substrate 12 in a uniform manner, a gas injection assembly 34, which **selectively** delivers and directs gas to a discrete region of the substrate in a

uniform and controlled manner, and an emissivity measurement assembly 60, which permits continuous emissivity measurement of the average surface area of the device side of the substrate during processing so that the amount and/or the profile of the heat being delivered to the substrate during processing may be adjusted.

US-PAT-NO: 5819684

DOCUMENT-IDENTIFIER: US 5819684 A

TITLE: Gas injection system for reaction chambers in CVD systems

---------- KWIC ---------

Brief Summary Text - BSTX (22):
It is yet another object of this invention to provide an improved gas injector for a reaction chamber wherein the velocity profile of the injected gas may be **selectively controlled** for optimum uniformity of deposition.

no gas temp

US-PAT-NO: 6331483

DOCUMENT-IDENTIFIER: US 6331483 B1

TITLE: Method of film-forming of tungsten

---------- KWIC ---------

Detailed Description Text - DETX (9):
Concretely, a boron-containing gas for a tungsten seed crystal forming process can be supplied to the shower head 28. Process gas sources for supplying WF.sub.6 gas, Ar gas, SiH.sub.4 gas, H.sub.2 gas, N.sub.2 gas and B.sub.2 H, gas are connected to the shower head 28. Each of pipes connecting the process gas sources to the shower head 28 is provided with a mass-flow controller 34, i.e., flow controller, and two shutoff valves 36 and 38 disposed on the opposite sides of the mass-flow controller 34, respectively. The flow rate of each gas can be controlled and the gas can **selectively** be supplied or stopped.

US-PAT-NO: 6300256

DOCUMENT-IDENTIFIER: US 6300256 B1

TITLE: Method and device for producing electrically conductive continuity in semiconductor components

---------- KWIC ---------

Detailed Description Text - DETX (16):

For the purpose of cooling the semiconductor wafer 10 inserted in the support 3a, an inert gas, in particular helium, is used, to set the optimum temperature field for the process of thermo-migration on the under side of the semiconductor wafer 10. For the purpose of separate control of the temperature on the upper surface of the semiconductor wafer 10 and on the lower surface thereof, the area at the level of the frame 3a is preferably sub-divided in such a way that both the gas pressure and the flow speed can be adjusted **separately** in the area above the frame 3a and below the frame 3a. The separate temperature control that is thus possible creates the pre-condition for an optimum course of the thermo-migration process so that electrically conductive passages in the disc-form semiconductor are created in minimum time without buckling due to thermal straining of the semiconductor wafer.

To be 8/1/03

DOCUMENT-IDENTIFIER: US 20010054601 A1

TITLE: LOW CEILING TEMPERATURE PROCESS FOR A PLASMA REACTOR WITH HEATED SOURCE OF A POLYMER-HARDENING PRECURSOR MATERIAL

---------- KWIC ---------

Detail Description Paragraph - DETX (49):

[0090] In the embodiment of FIG. 8A, the ceiling 152 and side wall 150 are separate semiconductor (e.g., silicon) pieces insulated from one another having separately controlled RF bias power levels applied to them from respective RF sources 1210, 1212 to enhance control over the center etch rate and selectivity relative to the edge. As set forth in greater detail in above-referenced U.S. application Ser. No. 08/597,577 filed Feb. 2, 1996 by Kenneth S. Collins et al., the ceiling 152 may be a semiconductor (e.g., silicon) material doped so that it will act as an electrode capacitively coupling the RF bias power applied to it into the chamber and simultaneously as a window through which RF power applied to the solenoid 142 may be inductively coupled into the chamber. The advantage of such a window-electrode is that an RF potential may be established directly over the wafer (e.g., for controlling ion energy) while at the same time inductively coupling RF power directly over the wafer. This latter feature, in combination with the **separately controlled** inner and outer solenoids 142, 190 and center and peripheral gas feeds 164a, 164b greatly enhances the ability to adjust various plasma process parameters such as ion density, ion energy, etch rate and etch selectivity at the

workpiece center
relative to the workpiece edge to achieve an optimum uniformity. In this
combination, pressure and/or gas volume through individual gas feeds is
individually and **separately controlled** to achieve such optimum uniformity of
plasma process parameters.

To Be 8/1/03

US-PAT-NO: 5232145

DOCUMENT-IDENTIFIER: US 5232145 A

TITLE: Method of soldering in a controlled-convection surface-mount reflow furnace

---------- KWIC ---------

Detailed Description Text - DETX (2):

FIGS. 1 and 2 illustrate a controlled-convection furnace of the present invention, referred to by the general reference numeral 10, having zones one through six. Furnace 10 comprises a one-piece, welded, low-thermal mass metal muffle 12 coated on the outside with a high emisivity material 14 to increase responsiveness. Integral to muffle 12 are three exhaust ports 16-18 equipped with venturi extractors 20-22. The first exhaust port 16 is located between an entrance 24 and the start of zone one, the second exhaust port 17 is positioned between zones two and three, and the third exhaust port 18 is arranged to remove reflow atmosphere from each end of a reflow zone, zone five. All three exhaust ports 16-18 are separately adjusted by individual pressure regulators (detailed below) and are monitored from zero to 2.00 inches by a magnehelic pressure gauges (see discussion for FIG. 3, below). Muffle 12 further comprises three heated gas plenums 26-28, Plenum 26 is above conveyor belt 30 in zone four. Plenums 27 and 28 are above and below belt 30, respectively, in the reflow section, zone five. Each of plenums 26-28 is equipped with its own **separately controlled** in-line gas heater. The flow rate of gas to each plenum 26-28 is controlled by a flowmeter. Inside muffle 12, in

zones one through three, there are right and left gas distribution tubes which are connected to flowmeters (see below). Sample ports are preferably provided in zones one through five within muffle 12 for analysis of the reflow atmosphere. Outside of muffle 12, and in close proximity to it, are low thermal mass, insulated panel heaters 46-53. In zones one through three, the top and bottom heaters 46-51 are controlled in tandem, while heaters 52-53 in zone five are controlled individually. At the end of muffle 12, in zone six, are top and bottom quench plenums 56 and 58, respectively. Plenums 56 and 58 are individually controlled by flowmeters. An inert gas curtain (not shown) is preferably provided at entrance 24.

Claims Text - CLTX (13):

reflowing solder on said assembly in a reflow processing zone that follows the stabilization processing zone, said reflow processing zone having a plurality of heating elements, said reflow processing zone heating elements disposed outside said muffle and hot gas plenums above and below the line of travel of said assembly, each of said heat sources being **separately controlled**;

T's Be. 8/1/03

US-PAT-NO: 5629054

DOCUMENT-IDENTIFIER: US 5629054 A
See image for Certificate of Correction

TITLE: Method for continuously forming a functional deposit film of large area by micro-wave plasma CVD method

---------- KWIC ---------

Detailed Description Text - DETX (552):
The present inventor made studies with efforts to solve the above-mentioned problems in a conventional semiconductor deposited film forming apparatus and accomplish the aforementioned objects of the present invention, and obtained such a view that the microwave plasma can be excited uniformly in a longitudinal direction of a microwave antenna within a film formation chamber, with its plasma potential controlled, in such a manner that the side wall of film formation chamber are constituted of continuously moving strip member, microwave antenna means is covered with a microwave transparent member and projected into the film formation chamber, a source gas for the film formation is introduced into the film formation chamber, which is retained at an appropriate pressure to cause the gas diffusion easily, the microwave is supplied to the microwave antenna means from a microwave power source, and a bias voltage is applied to bias applying means disposed **separately** from the strip member.

Detailed Description Text - DETX (707):
The film formation chamber of FIG. 18 is evacuated via a

slit-like opening portion 110 and an evacuation port 107 by a vacuum pump, not shown. After the internal pressure of the film formation chamber reaches 1.times.10.sup.-6 the source gases for the formation of deposited film, each flow of which is **separately controlled** by a master controller not shown, are introduced via three gas inlet conduits 106a, 106b, 106c into the film formation chamber 104, respectively. In this state, after the internal pressure of the film formation chamber reaches a predetermined pressure, the microwave power generated by a microwave oscillator of 2.45 GHz (e.g., made by Evick & Co.), not shown, is input via the square waveguide 301, the waveguide coaxial transducer 313, the central conductor and the microwave transparent dielectric tube 103 as shown in FIG. 3 into the film formation chamber. To make effective use of the microwave power, it is preferable to make the impedance matching of the microwave as well known. In the apparatus of the present invention, an insertion length adjusting mechanism of the central conductor 102 and the coaxial plunger 302, as shown in FIG. 20, are incorporated as an impedance matching mechanism of the microwave. Since the former central conductor insertion length adjusting mechanism of such microwave impedance matching mechanism has a wider matching range, it is preferable to first adjust the reflected power with the insertion length adjusting mechanism so that the reflected power may be as least as possible, using a reflected power meter for monitoring the reflected power within the coaxial line or waveguide, and subsequently match the impedance by making the fine adjustment with the coaxial plunger 302. As a result, the plasma is excited within the film formation chamber 104. With the action of the plasma thus generated, a desired high quality

functional deposited film
with its composition controlled is formed on the strip
member 101.

	U	1 [1]	Document ID	Issue Date	Pages	Title	Current OR	Current XRef	Retrieval Classif
1	☐	☒	US 20010054601 A1	20011227	40	LOW CEILING TEMPERATURE PROCESS FOR A PLASMA REACTOR WITH HEATED SOURCE OF A POLYMER-HARDENING PRECURSOR MATERIAL	216/68	216/72; 216/79; 257/E21.252; 438/710; 438/714; 438/723; 438/729; 438/735; 438/743	
2	☐	☒	US 20010041218 A1	20011115	12	HIGH RATE SILICON NITRIDE DEPOSITION METHOD AT LOW PRESSURES	427/248.1		
3	☐	☒	US 6589437 B1	20030708	43	Active species control with time-modulated plasma	216/68	216/67; 216/71	
4	☐	☒	US 6514376 B1	20030204	44	Thermal control apparatus for inductively coupled RF plasma reactor having an overhead solenoidal antenna	156/345.37	118/723AN; 118/723I; 118/723IR; 118/724; 118/728; 156/345.53; 156/48; 204/298.09; 204/298.31; 257/E21.252	
5	☐	☒	US 6506691 B2	20030114	12	High rate silicon nitride deposition method at low pressures	438/791	156/89.15	
6	☐	☒	US 6486069 B1	20021126	17	Cobalt silicide etch process and apparatus	438/706	438/710; 438/714; 438/715; 438/719; 438/721	